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PROBLEMS.

15. Proposed by A. L. FOOTE, No. 80, Broad St., New York.

A person 30 years of age has an annuity for 10 years, the present worth of which is $1000, provided he lives but ten years; for, if he dies, the annuity ceases. What is the annuity worth, on the assumption that 75 out of every 4385 persons die annually, between the ages 30 and 40 years?

16. Proposed by H. W. DRAUGHON, Clinton, Louisiana.

The probability that *A* will speak the truth is twice the probability that *B* will, in an independent statement, speak the truth; but, if *A* exerts his influence, the probability is that *B* will agree with him in any statement. What is the probability of the truth of their concurrent testimony, the chances being equal that *A* may or may not be interested in the matter?

17. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Find the average area of the circle which is the locus of the middle points of all chords passing through a point taken at random in the surface of a given circle.

Solutions to these problems should be received on or before November 1st.

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MISCELLANEOUS.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS TO PROBLEMS.

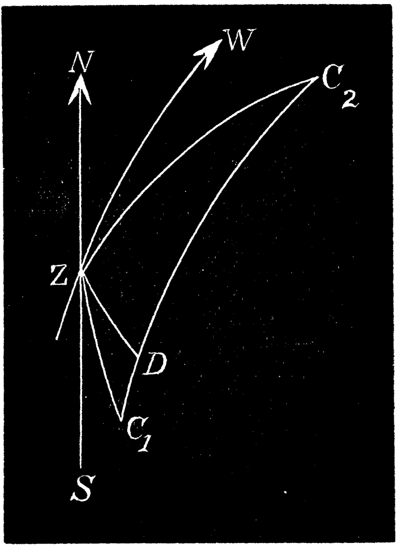
10. Probosed by SAMUEL HART WRIGHT, M. D., M. A., Ph. D., Penn Yan, Yates County, N. Y.

A small cloud in the S. E. and altitude 70°, was soon after N. 60°E with an altitude of 30°. In what direction was the wind blowing, the track of the cloud being the arc of a great circle?

I. Solution by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Let Z represent the zenith of the observer, C_1 and C_2 the positions of the cloud, and ZD the perpendicular C_1C_2. The $\angle NZW$ represents the direction of the wind with respect to the observer and his zentith. Since $C_1Z=20^\circ$, $C_2Z=60^\circ$, $\angle C_1ZC_2=75^\circ$, $\angle C_1ZS=45^\circ$, and $\angle C_2ZN=60^\circ$, the spherical triangle C_1ZC_2 gives $\angle C_1C_2Z=\phi=\tan^{-1}\left(\frac{\cos 20^\circ}{\cos 40^\circ}\cot 37\tfrac{1}{2}^\circ\right)$

$-\tan^{-1}\left(\frac{\sin 20^\circ}{\sin 40^\circ}\cot 37\frac{1}{2}^\circ\right)=23^\circ\ 14'\ 3''.7083$; and the spherical triangle C_2ZD gives $\angle C_2ZD=\psi=\cot^{-1}(\cos 60^\circ\div\cot\phi)$ $=77^\circ\ 53'\ 6''$. Obviously *the direction of the wind*, represented by $\angle NZW$, $=C_2ZD+\angle C_2ZN-90^\circ=\psi+60^\circ-90^\circ=\psi-30^\circ$, $=$N. $47^\circ 53' 6''$E.; for at D the zone of the air in motion moves at right angles to ZD, and from D to Z the same zone moves also parallel with itself.



II. Solution by G. B. M. ZERR, Principal of High School, Staunton, Virginia.

Let A be the station of the observer on the earth, Z his zenith, MZN his meridian. B, C the positions of the cloud at first and last observation, $KBCP$ the cloud's track, FG a plane through A perpendicular to ZA, D, E the projections of B, C on this plane.

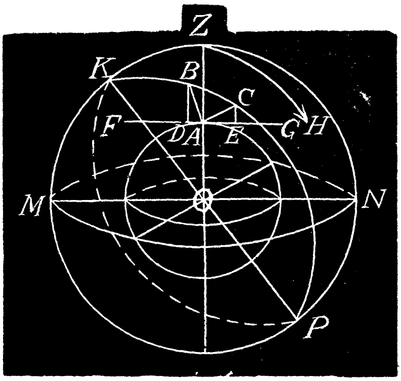
Let $AD=m$, $AE=n$, AZ, AG the X, Y axes. The plane of the cloud with reference to the observer passed through the points A, B, C.

$\therefore$ coordinates of A, $(0, 0, 0)$;

coordinates of B, $(m\tan 70^\circ, -m\cos 45^\circ, m\sin 45^\circ)=\left(m\tan 70^\circ, -\frac{m}{\sqrt{2}}, \frac{m}{\sqrt{2}}\right)$;

coordinates of C, $(n\tan 30^\circ, n\cos 60^\circ, n\sin 60^\circ)=\left(\frac{n}{\sqrt{3}}, \frac{n}{2}, \frac{n\sqrt{3}}{2}\right)$.

$$\therefore \begin{vmatrix} x, & y, & z, & 1 \\ 0, & 0, & 0, & 1 \\ m\tan 70^\circ, & -\frac{m}{\sqrt{2}}, & \frac{m}{\sqrt{2}}, & 1 \\ \frac{n}{\sqrt{3}}, & \frac{n}{2}, & \frac{n\sqrt{3}}{2}, & 1 \end{vmatrix}=0,$$ is the equation of this plane.



The direction of the wind is represented by ZH parallel to $KBCP$ through the zenith Z.

Let $x=0$, and we get

$$\begin{vmatrix} 0, & y, & z, & 1 \\ 0, & 0, & 0, & 1 \\ m\tan 70^\circ, & -\frac{m}{\sqrt{2}}, & \frac{m}{\sqrt{2}}, & 1 \\ \frac{n}{\sqrt{3}}, & \frac{n}{2}, & \frac{n\sqrt{3}}{2}, & 1 \end{vmatrix}=0,$$ is the equation of the trace of the plane ZHO on the plane YZ.

Writing out the determinant we get $(3\sqrt{2}\tan 70^\circ-2)y=(\sqrt{6}\tan 70^\circ+2)z$.

$$\therefore\ \theta=\angle HZN=\tan^{-1}\left\{\frac{3\sqrt{2}\tan 70^\circ-2}{\sqrt{6}\tan 70^\circ+2}\right\}=47^\circ\, 53'\, 6.''6.$$

$\therefore$ N. 47° 53′ 6.″ E. is the direction of the wind.

Also solved by *A. H. BELL*, and the *PROPOSER*.

PROBLEMS.

16. Yale Senior Prize Problem.---Contributed by H. A. NEWTON, LL. D., Professor of Mathematics, Yale College, New Haven, Connecticut.

The axes of two right cylinders whose bases are circles of 4 and 6 inches radius respectively, intersect at right angles; compute to four decimal places the lengths of the curves of intersection of the two surfaces.

Proposed by SAMUEL HART WRIGHT, M. D., M A., Ph. D., Penn Yan, Yates county, New York.

A bright star passed my meridian at 7 P. M. The Chronometer soon after ran down and stopped, but I set it again when the same star had a true altitude of $30^\circ=\alpha$. What time was it then, my latitude being $42^\circ 30'\text{N.}=\lambda$, and the star's Declination $60^\circ\text{N.}=\delta$?

Solutions to these problems should be received on or before November 1st.

QUERIES AND INFORMATION.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

6. A reply to Professor WHITAKER'S Comment, by H. W. DRAUGHON.

Professor Whitaker's explanation of the difficulty in L. B's solution seems to me illogical. L. B's answer is correct, and does prove if properly substituted.

Professor Whitaker does not discriminate between the sign indicating operation, placed before an expression, and the sign of the *value* of that expression found by solution. For instance, let us take the equation under discussion, $x-4=+\sqrt{x-4}+4\ldots.(1)$.

Squaring, we readily find, $\sqrt{x-4}=-1$. The + sign before $\sqrt{x-4}$ in (1), merely indicates that the value of $\sqrt{x-4}$, be it positive or negative, is to be added to 4. If Professor Whitaker insists that $\sqrt{x-4}$ cannot have a negative value, he must deny that x can have a negative value in the following equation: $x^2+2x=3\ldots.(2)$. To illustrate, let the value of x^2 be required; we readily find $x^2=9$ and $x^2=1$.

From the first result, we obtain $x=3$, which does not satisfy (2), but